VERSION WITH MARKINGS SHOWING CHANGES MADE

FIRE DOOR LOCK MECHANISM

FIELD OF THE INVENTION

The present invention relates to fire door lock mechanisms, and more particularly, to a fire door lock mechanism which allows a user to easily push forwards to open a fire door mounted with the fire door lock mechanism.

BACKGROUND OF THE INVENTION

A conventional fire door, as shown in FIG. 1, is opened by pressing a handlebar 11 of a handlebar mount 10 horizontally located in the middle of the fire door, whereby a lock bolt 12d in a lock body 12 is retracted and relieves a locked state that closes and locks the fire door, thereby making the fire door opened. This operation is achieved by a diagonal depression motion of the handlebar 11 which is pressed by a user to move in a downward and diagonal direction. Please refer to FIGs. 2 and 3 which shown the structure of a conventional fire door lock being rotated by 90 degrees to be oriented in a horizontal direction for clear illustration. The handlebar mount 10 houses a handlebar 11 that allows a user to press downwards and a lock body 12 that accommodates a lock boll 12d. The handlebar 11 is screwed to two horseshoes 13 located at the bottom of the handlebar mount 10. A roller 13b penetrates through two slanted slots 13a respectively formed on two side walls of each horseshoe 13 and is fixed to the side walls of the horseshoe 13 by means of a ~~shim~~ pin 13c. A pin 13e having a wound elastic member 13d thereon is secured to the bottom of each horseshoe 13, wherein one end of the elastic member 13d is in contact with the bottom of the roller 13b on which an upward compression force is exerted. Under a normal condition, the ~~shim~~ pin 13c of the roller 13b holds the handlebar 11 in position at the top of the handlebar

mount 10. When the user exerts a force on the handlebar 11, the roller 13b is pushed downwards and travels along the slots 13a of each horseshoe 13 by the force, thereby inducing diagonal translocation of the handlebar 11 in the handlebar mount 10. The lock body 12 located at the front of the handlebar mount 10. shown in FIG. 3. comprises a seesaw lever 12a which is constructed by coupling a push part 12b and a pull part 12c, wherein the push part 12b is in contact with an inside surface of the handlebar 11 and the pull part 12c is engaged with a cavity 12e formed by the lock bolt 12d in the lock body 12. When the user presses the handlebar 11, the push part 12b of the lever 12a is pushed downwards while the pull part 12c is moved upwards. At the same time, the pull part 12c comes into contact with the lock bolt 12d which is driven to rotate in a counterclockwise direction, making the lock bolt 12d retracted into the lock body 12 to facilitate a door opening action.

In view of the above door opening operation in the use of the conventional fire door lock, although the user presses the handlebar 11 in a manner as illustrated by the arrow in F1G. 3. the handlebar 11 is moved in a diagonal direction by the roller 13b travelling along the slots 13a of each horseshoe 13 in the handlebar mount 10. The diagonal movement of the handlebar 11 is composed of a vertical movement and a horizontal movement. And the force exerted by the user is undesirably divided into two components: a force vertical to the push part 12b and used for operating the lock bolt 12d, and a force horizontal to the push part 12b and having no contribution to the lock bolt 12d, which therefore requires a larger amount of force exerted by the user due to wastage. Further, the horizontal movement of the handlebar 11 makes the travel direction of the handlebar 11 different from that of the hands of the user, which causes discomfort to the hands of the user when operating the door lock.

Furthermore, when the lock bolt 12d of the conventional fire door lock is extended from the lock body 12, as shown in FIG. 1, the lock bolt 12d is inserted into a catch 14 which

has an opening for accommodating the lock bolt 12d and which is adhered to a surface of a door frame of the fire door. However, the catch 14 protrudes outwardly from the surface of the door frame and thus distorts the overall appearance. Moreover, the exposed catch 14 is easily subject to damage from vandals. Therefore, a novel fire door lock which can eliminate the above drawbacks is greatly desired.

SUMMARY OF THE INVENTION

An objective of the present invention is to provide a fire door lock mechanism which allows users to press a handlebar in a vertical direction with respect to a first door mounted with the fire door lock mechanism to activate a lock bolt in a comfortable manner to open the first door.

Another objective of the invention is to provide a fire door lock mechanism which allows the lock bolt extended from a lock body to be directly inserted into a hole formed on an inner side of a door frame, such that when the door lock mechanism is engaged, the lock bolt cannot be easily damaged by vandals, thereby increasing the security of the door lock mechanism.

In order to achieve the above and other objectives, the present invention provides a fire door lock mechanism which allows a first opening unit thereof to be located inside a fire door mounted with the lock mechanism and to activate a lock bolt of the lock mechanism to move. Moreover, a second opening unit laterally located on the fire door has a handlebar coupled with an actuator for operating the lock bolt. When the handlebar is pushed and pressed by a user, the actuator activates a push rod and a link arm to move horizontally. One end of the link arm is coupled to a swing arm which is thus induced by the link arm to generate a swing motion, wherein one end of the swing arm has a pulley expending into the

first opening unit to activate a lock bolt mounted connected to the lock bolt to move horizontally. As a result, the lock bolt is accordingly adapted to extend from or retract into the first opening unit in a horizontal direction to facilitate the release or engagement of the lock mechanism.

Furthermore, the first opening unit of the fire door lock mechanism comprises a rotation member having at least one disk coupled to a rotational handle, so as to allow the disk to be driven by the rotational handle to activate a rotatable plate having an arm that is coupled to the lock bolt mount. When the rotatable plate rotates, the arm exerts a force on the lock bolt mount and induces the lock bolt mount to move horizontally, such that the lock bolt connected to the lock bolt mount can extend from and retract into first opening unit to engage or disengage the lock mechanism, thereby making the user to operate the handlebar and open the fire door in a comfortable manner.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention can be more fully understood by reading the following detailed description of the preferred embodiments, with reference made to the accompanying drawings, wherein:

FIG. 1 (PRIOR ART) is a schematic diagram of a fire door mounted with a conventional fire door lock;

FIG. 2 (PRIOR ART) is a schematic diagram showing the structure of the conventional fire door lock;

FIG. 3 (PRIOR ART) is a schematic diagram showing the mechanics of the conventional fire door lock;

FIG. 4 is a schematic diagram of a fire door mounted with a fire door lock mechanism

according to a preferred embodiment of the invention;

FIG. 5 is an exploded diagram of a first opening unit of the fire door lock mechanism according to the invention;

FIG. 6 is an exploded diagram of a second opening unit of the fire door lock mechanism according to the invention;

FIG. 7 is a schematic diagram showing part of components of the fire door lock mechanism according to the invention; and

FIGs. 8A and 8B are perspective diagrams showing the structure of the fire door lock mechanism according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 4 is a schematic outlook of a fire door mounted with a fire door lock mechanism according to a preferred embodiment of the invention. This lock mechanism comprises a first opening unit 2A and a second opening unit 2B having a handlebar 35. The first opening unit 2A is disposed between door panels inside the fire door for activating a lock bolt 21 to extend from and retract into the first opening unit 2A in a horizontal direction so as to engage or disengage the lock mechanism.

Please refer to FIGs. 5 and 6 which respectively illustrate the first opening unit 2A and the second opening unit 2B. The first opening unit 2A comprises: a lock body 20 for accommodating the components of the lock bolt 21, and a rotation member 23 connected to an external rotational handle 25, the rotation member 23 having an-upper disk 23a and a lower disk 23a each of which is coupled to a rotatable plate 23b, so as to allow an arm 23c formed on the rotatable plate 23b to induce a horizontal movement of lock boll mount 22. A slot 24 is located at the bottom of the lock body 20 and horizontally corresponds to a

protrusion 22a formed on a side of the lock bolt mount 22, One end of the lock bolt mount 22 is coupled to the lock bolt 21, As a result, the lock bolt 21 can freely extend from and retract into the lock body 20 along with the horizontal movement,

Referring to FIG, 6, the second opening unit 2B comprises: a lock cover 30 for covering the components of the lock bolt 21, wherein the bottom of the lock cover 30 is coupled to a lock cover mount plate 31 and one end thereof is coupled to a base plate 32 engaged with a recessed base mount 33: a first horseshoe 34 provided at each of two ends of the base plate 32 and having a substantially triangular shape with a hole 34a located on a top side thereof; a handlebar 35 received in the base mount 33 and capable of being pressed by a user to move to disengage the lock mechanism; a second horseshoe 36 located at each of two bottom ends of the handlebar 35 and having a substantially triangular shape with a hole 36a located on bottom side thereof; an actuator 37 bent by a right angle to form a central portion 37a having a hole 37d, a left end portion 37b having a hole 37e, and a right end portion 37c having a hole 37f; a push rod 38 of an elongated shape having each end thereof being inserted with a ~~shim~~ pin 38a which is coupled to the hole 37e of the left end portion 37b of the actuator 37; a link arm 39 coupled to an end of the push rod 38 and induced by the push rod 38 to generate a horizontal force; a swing arm 40 coupled to an end of the link arm 39 and induced by the link arm 39 to generate a swinging motion, so as to allow the swing arm 40 to extend through the slot 24 of the first opening unit 2A (FIG, 5)to induce the horizontal movement of the lock bolt mount 22; and a lock cover mount 41 for receiving the link arm 39 and the swing arm 40, the swing arm 40 being secured to the lock cover mount 41 by a ~~shim~~ pin 41 b to allow the swing motion thereof. By the coordination of the aforementioned components, the user can easily press the handlebar 35 forward in an energy-saving and comfortable manner to release the lock mechanism.

The second horseshoes 36 coupled to the handlebar 35 each is formed with a hole 36a

at the bottom thereof for accommodating a ~~shim~~ pin 36b inserted into the hole 37f of the right end portion 37c of the actuator 37, thereby allowing the actuator 37 to use the ~~shim~~ pin 36b as a pivot to rotate. Furthermore, the actuator 37 is formed with a recess portion by which the actuator 37 can be bridged on the push rod 38. A ~~shim~~ pin 34b is inserted into the hole 37d of the central portion 37a of the actuator 37 and the hole 34a of the first horseshoe 34 to connected the actuator 37 and the first horseshoe 34. When the second horseshoe 36 receives a force from the handlebar 35 pressed by the user and moves, the left end portion 37b of the actuator 37 is accordingly adapted to move at the same time, making the right end portion 37c of the actuator 37 to swing about the ~~shim~~ pin 34b as a pivot in the hole 34a of the first horseshoe 34, to thereby induce a horizontal movement of the push rod 38 and the link arm 39 coupled to the push rod 38.

A front end of the link arm 39 is formed with a bent portion 39a bent by a right angle whose bottom has a hole 39b for accommodating a ~~shim~~ pin 39c which is coupled to a hole 40b located at a central position of the swing arm 40 to thereby connect the link arm 39 and the swing arm 40. The ~~shim~~ pin 39c is further coupled to an elliptic slot 41e of the lock cover mount 41, whereby the horizontal displacement of the ~~shim~~ pin 39c in the slot 41c can increase the swinging amplitude of the swing arm 40. The swing arm 40 is further provided with a hole 40c for receiving a ~~shim~~ pin 41 coupled to a holes 41 of the lock cover mount 41; as such, the swing arm 40 can be adapted to generate the swing motion by the link arm 39 with the ~~shim~~ pin 41a serving as a pivot. Further, a hole 40a is located at the bottom of the swing arm 40 for receiving a ~~shim~~ pin 42a which connects a pulley 42 to the bottom of the swing arm 40. The pulley 42 can extend from a slot 31 a at a central position of the lock cover mount plate 31 or retract into the slot 24 at the bottom of the lock body 20. The pulley 42 is in contact with the protrusion 22a of the lock bolt mount 22 and extended out of the lock body 20 by the swing motion of the swing arm 40 to allow the lock mechanism in an

engage state.

As shown in FIG, 5, the lock body 20 receives the rotation member 23 coupled to the rotational handle 25 ~~opera table~~ operable by the user. The rotational handle 25 is disposed on a side of the fire door that faces the outside and coupled to the rotation member 23 by a square-shaped column 26. The rotation member 23 has the upper and lower disks 23a, 23a respectively connected to the upper and lower rotatable plates 23b, 23b. Each of the rotatable plates 23b has an arm 23c engaged with a recess portion 22b of the lock bolt mount 22. When the disks 23a are driven by the rotational handle 25 to rotate, the arms 23c rotate to induce the lock bolt mount 22 to move horizontally.

A through hole 22c is formed at a central position of the lock bolt mount 22 and accommodates a flat front close end 27a of a shaft 27. A hole 27b is formed at the flat front end 27a of the shaft 27 for receiving a screw 27c connected to the lock bolt 21. As shown in FIG. 7, a hole 27d is formed at the other open end of the shaft 27 and has a predetermined depth which allows a rod 28 sleeved with an elastic member 27e thereon to be inserted into the hole 27d. The rod 28 has one end formed with a flange 28a that has a larger diameter than the elastic member 27e for securing the elastic member 27e in position. The elastic member 27e has a length greater than that of the rod 28 and the depth of the hole 27d of the shaft 27, such that by provision of the flange 28a of the rod 28, the elastic member 27e is held in a compressed status inside the hole 27d of the shaft 27.

Furthermore, the flange 28a of the rod 28 is inserted into a hole 20a on a side wall of the lock body 20: as such, one end of the rod 28 is secured to the lock body 20. making the elastic member 27e at the other end of the rod 28 press the shaft 27 to move towards a lock bolt catch 29 (as shown in FIGs. 4 and 5) and thereby inducing the lock bolt 21 to protrude from the lock body 20. When the recess portion 22b of the lock bolt mount 22 is moved by the arms 23c of the rotatable plates 23b of the rotational handle 25, due to a force exerted

from the arms 23c being greater than a force pressed on the shaft 27 by the elastic member 27e, the lock bolt mount 22 is pushed by the arms 23c towards a direction away from the lock bolt catch 29, making the lock bolt 21 retract into the lock body 20 to release or disengage the lock mechanism.

Moreover, the protrusion 22a is located on one side of the lock bolt mount 22, the slot 24 formed at the bottom of the lock body 20 horizontally corresponds to the protrusion 22a in position. As shown in FIGs. 8A and 8B, the swing arm 40 is inserted into the slot 24, and the pulley 42 at the bottom of the swing arm 40 is in contact with the protrusion 22a of the lock bolt mount 22. When the handlebar 35 is pressed by the user as shown in FIG. 4, the push rod 38 is pushed to generate the swing motion of the swing arm 40, and the pulley 42 of the swing arm 40 induces the lock bolt mount 22 to move horizontally, making the lock bolt 21 coupled to the lock bolt mount 22 move away from the lock bolt catch 29 and retract into the lock body 20 to disengage the lock mechanism.

Besides, the lock bolt mount 22 can be made of a heat melting material. When the fire door lock mechanism experiences a high temperature in a fire, the lock bolt mount 22 melts and the shaft 27 fails to be moved by the arms 23c of the rotatable plates 23b of the rotation member 23. In the meantime, pressing the rotational handle 25 or the handlebar 35 cannot push the shaft 27 to move towards a door frame of the fire door; on the other hand, the elastic member 27e inside the shaft 27 and on the push rod 28 can generate a compression force to move the shaft 27 towards the lock bolt catch 29, thereby making the lock bolt 21 connected to one end of the shaft 27 move towards the lock bolt catch 29 and extend from the lock body 20 to maintain the door mechanism in a locked state during the fire. As a result, the lock mechanism cannot be released or disengaged by operating the external rotational handle 25 or the handlebar 35, such that the fire door cannot accidentally opened during the fire and the flames can be prevented from spreading to unintended areas to damage people for the sake of

the safety purpose.

The present invention has been described using exemplary preferred embodiments. However, it is to be understood that the scope of the invention is not limited to the disclosed embodiments. On the contrary, it is intended to cover various modifications and similar arrangements; for example, the connection means between the swing arm 40 and the lock bolt mount 22 can be replaced by a hook or a ~~shim~~ pin, or the elastic member 27e can be modified to externally wrap the shaft 27 or directly mounted inside the shaft 27. The scope of the claims, therefore should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.